Ph.D Synopsis

Subject:-Computer Science

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3. **Title of proposed Thesis:-** **Deep Learning Model for Diagnosis of Some Critical Diseases.**

4. INTRODUTION

The Critical diseases are most dangerous diseases. These diseases if occurred may cause death of patients or permanent or temporarily disability of any organ. These diseases are very hard to recover. There are number of types of critical diseases like heart attack, stroke, coronary artery disease, cancer, kidney failure, Viral Hepatitis, Major Organ Transplant, Paralysis / Paraplegia, Blindness, Heart Valve Replacement, Loss Of Hearing / Deafness, Loss of Speech, Alzheimer's Disease, Major Burns, Coma, AIDS Due To Blood Transfusion, Parkinson's Disease, Chronic Liver Disease, Chronic Lung Disease, Brain Tumor, Brain Surgery, Bacterial Meningitis, Other Serious Coronary Artery Disease etc.

Diseases can be detected or diagnosed by going to hospitals in the past. For that purpose if patient has realize some symptoms or if he or she feels uncomfortable then he takes appointment of doctors and according to doctors timing the patient has to go to the hospital. Sometimes this process requires more time. Sometimes, patients get reports of tests from labs like blood report, ECG, X-Ray etc. and doctors hospitals are far away or lot of rush in hospitals patient avoid to go to hospitals due to time limitations then proposed research could be beneficial. For detection of critical diseases proposed application is developed using deep learning model that is CNN model with the help of python and tensor flow framework to accurately detect the critical diseases.

Deep learning is branch of machine learning. Using deep learning we can compute on multilayer neural network. Deep learning works in hierarchical manner. In deep learning there is number of hidden layers available that is more than 2 that’s why it is deep neural network. In machine learning only one hidden layer is available that’s why we could not do complex computations in machine learning. Due to this drawback output produced by machine learning algorithms is also less accurate than the deep learning algorithms. In deep learning number of layers are non-linear it can be in about 1000 layers to get more accurate result. Deep learning gives accurate results, due to extensive variation from patient to patient traditional approaches of machines learning could not give better result.

In this research we can perform text analysis of symptoms from dataset and we can perform image analysis of MRI, CT scan, X-RAY, Sono-Graphy, PET- Scan etc. images from dataset.

The model is then deployed to predict the chances of whether critical diseases is present or not and if you have a critical disease then which kind of disease you have is obtained with this research text and images are compared with training dataset and using CNN model we can predict the critical disease is present or not present.

Convolutional Deep Neural Network (CNN):-It is best for 2-D data. If numbers of hidden layers are increased as well as weight and bias values are also increased then at that time network becomes complex and it becomes very hard to compute at that time CNN model is used it works well on highly complex network. CNN model passes moving filter on image. It applies to certain neighborhood of nodes i.e possibly be pixels.CNN model drastically reduce the number of parameters that need to be tuned & handles high dimensionality of raw images. In CNN model when input is given it creates feature maps that gives number of features and then sub sampling is performed on layers in that we select required features out of number of features after that fully convoluted map is created that gives our output. If errors occurred during training then Gradient Decent Optimization Technique is used to adjust the weights most of the time. Feed forward and back propagation algorithms are also used with computational graphs to do mathematical calculations as well as passing input to process nodes to activation function and it produces output is produces. If error is produced then it sends back to input to reprocess again using back propagation algorithm we have forward pass and backward pass for it. We adjust the weight until stopping criteria is met.

Tensor flow framework:-It has python library functions. It is based on computational graph. In computational graph nodes represent data and edges represent flow of data between nodes which is multidimensional array or tensor hence name is tensor flow.

Output from operation or set of operation is act as input to next level. It is used in neural network or other where data flow graph is used. Tensor flow uses several features from Theano framework like sub expression elimination, auto differentiation, shared & symbolic variables. We can also implement all deep neural network models using this framework like Convolution, RNN, RBM, DBM, auto encoders, RNTN, RNN, and RBM etc. Tensor flow framework is used as backend of Keras framework.

Keras Framework:-It is easy use for using python library developing, evaluating deep learning models. Very few lines of code is required to train network. It runs on top of number of lower level libraries. Like tensor flow, theano .We can implement network in keras using thaeno or tensor flow as a backend without any changes in code.

5. Research Problem:-

The Need for Present Investigation:-

You can detect the critical diseases with the proposed software using CNN model and Tensor flow framework.

In past diagnosing the critical diseases is not possible if you are not going to hospital .It is time consuming process as doctors has fixed time to check patient. Lot of rush in hospital makes patient irritate and avoid to go to hospital. Number of times appointment is not get that's why patient avoid to go to hospital at that time this proposed application could be used to diagnose the disease at early stage. You can detect the disease anywhere anytime.

There are number of applications in the market in the past related to diagnosing the diseases. They can either do text analysis or image analysis not both. In the past there are lot of applications are available but all applications don't have that much accuracy even some of them don't have base to diagnose the disease. The proposed research work is mainly developed to get more accuracy in diagnosing the critical diseases. With the deep learning model that is CNN model one can easily get required features to diagnose the disease. In past if application is related to diagnosing the disease then in that application prevention techniques and medication required for cure is not available. The proposed application provides medication and prevention facilities.

Details of proposed implementation:-

1) Explore patient data using data set.
2) Data processing is used to correct the data.
3) Create our neural network in tensor flow framework.
4) Train the model by comparing with stored dataset.
5) Predict critical disease present or not from patient data that is classification.

6) You can then get information related to prevention and medication required for disease using particular module.

- In the text analysis then all the symptoms are taken from the patient and we can match the pre stored symptoms from dataset. This could be possible by using python software and CNN model deployed using tensor flow network.
- In the image analysis we can take any image like ECG,X-Ray, PET-Scan etc and we can compare it with stored images from dataset to diagnose the critical disease. We can use python software and CNN model with tensor flow network to deploy it.

6. Significance of Research work:-

This research will be beneficial for health care industries as well as in hospitals and at home to detect the critical disease accurately. Purpose of this research is to diagnose the critical disease accurately. Most of the times doctors also does the mistake in diagnosing the disease at that time this research could gives better result. This research is used at home to detect disease by using smart phones which supports android operating system. This research could be used to detect critical disease any where any time by connecting the mobile device to the internet. This research uses tensor flow framework and keras framework to deploy the model. We can detect any ones critical disease using this research by comparing it with our datasets. This research gives more accurate and fast result than human prediction.

7. Literature Survey:-

CNN model is used to deploy images or videos from mobile devices.CNN model is used for object detection to identify foliar symptoms of diseases in Cassava, then deploy model on mobile app & test its performance on mobile images & video of 720 diseased leaflets in agricultural field in Tanzania. Here authors investigate plant disease diagnostics on mobile device. Tensor flow platform is used to deploy a smart phone CNN object detection model designed to identify foliar symptoms of 3 diseases two types of pest damage & nutrient deficiency in Cassava. utilizes Single Shot multi box (SSD) model with the Mobile net detector & classifier pre-trained on the COCO(Common Object in Context) dataset of 1.5 Million images (80 object

categories).Dataset Consist of 2415 Cassava leaf images for pronounced symptoms of each class. Nutrient deficiency class of 336 images included to test performance.

For Detection images and videos are captured using mobile phones in cloudy condition if sunlight is on leaf then umbrella is used to avoid lighting problem. Leafs are also wiped so as they must not contain dust and water on it. Then CNN model was deployed on Samsung Galaxy S5 mobile using Tensor Flow demo app. The phone was held at parallel to leaf at distance such that all leaflets were visible in frame. Then it is classified it into following classes 1) Healthy.2) Brown Streak Disease 3) Mosaic Disease 4) Green Milte Damage 5) Red Milte Damage6)Brown Leaf Spot 7)Nutrient Deficiency. **[1]**

Deep learning algorithm mostly Convolutional Neural Network is mostly used in analyzing medical images. It is used for image classification, object detection, segmentation, registration and other tasks. Application areas are neuro, retina, pulmonary, digital pathology, Brest cancer, and cardiac, abdominal, musculoskeletal.

This survey includes over 30 papers most of them on deep learning in medical image analysis. Authors checked all references in all selected papers .The summery for all survey's shows that deep learning techniques have permeated the entire field of medical image analysis. Challenges in this field are explained & contributions to solve challenges are also described. All deep learning algorithms are also explained in this survey**.[3]**

This study applies deep learning model to recognize abnormalities in heart sound. Authors proposed an algorithm that combines the use of time frequency heat map representation with deep Convloutional Neural Network (CNN).The objective of this study was to classify the images accurately as normal or abnormal heart sounds. Recordings were collected from both healthy individual and those with heart disease including heart valve disease & coronary artery disease. Phonocardiography (PCG) shows graphs of normal and abnormal sounds. In this work authors presents an algorithm that accepts PCG waveform as input and uses deep Convoluational neural network to classify input as either normal sound or abnormal sound for classification. **[4]**

CNN algorithm is multilayer perceptron that is special design for identification of 2-D data information. It has more layers input layer, convolution layer, sample layer, output layer. This study gives detailed analysis of the process of CNN algorithm it uses both forward process & back propagation. To recognize heart data weka tool is used.

In this technique two main processes are convolution and sampling. Convolution process use a trainable filter then feature image of each layer namely feature map is obtained then add bias bx. We can get convolution layer cx.

In sampling process n pixels of each neighborhood through pooling steps become a pixel & then by scalar weighting wx+1. It shares weights, sub sampling time or space so as to extract feature & reduce the size of training parameters, then back propagation input derivation of Kth neuron in output layer is obtained & finally give selected feature & classification results obtained.**[6]**

Tumor classification is done using multiple kernel based probabilistic clustering & deep learning classifier is proposed. This proposed technique consists of 3 modules

1) Segmentation 2) Feature Extraction 3) Classification.

Initially MRI images is preprocessed then it is segmented using Multiple Kernel based Probabilistic Clustering (MKPL) then features are extracted for every segment based on shape, texture & intensity. After feature extraction important features will be selected using Linear Discriminant Analysis (LDA) for classification purpose. Finally Deep Learning Classifier is employed for classification into tumor or non tumor. The proposed technique also compared with feed forward & back propagation algorithm by the authors and they concluded that, proposed technique gives more accuracy and efficiency than existing algorithm**. [2]**

Authors stated the main application of this study is reduction of human judgment in the diagnosis of diseases. This study presents a solution for brain tumor segmenting by using deep learning. Authors studied different angles of brain MRI images & applied different models for segmentation.

Author uses 3 MRI views of brain segmentation technique based on CNN model.CNN extracts features directly from pixel images with minimal preprocessing. The network used in this study was Link net. It is light deep neural network architecture designed for segmentation. Link net consist of encoder and decoder blocks that arrange to break down to image & build it backup before passing it through a final convolution layer. The network starts with initial block that implements Convolution function with 7x7 kernels size & max-pooling with stride 2.

For training process single net network is used .Authors used 2100 images out of that 20 % images are considered as validation & rest of the data is used for test purpose using this study with the help of CNN model we can automatically segmenting the most common types of brain tumor like Gliema, Meningioma, & pituitary. This technique does not require preprocessing steps**. [5]**

The goal this research was to design new method based on deep learning to efficiently & quickly classify cardiac Arrhythmia. This research is based on 1000 ECG signal fragments from the MIT-BIH Arrhythmia database for one lead(ML-II) from 45 persons using deep learning CNN model feature extraction, selection & classification can be done in one stage. It achieves 91.33% accuracy & classification time required per single sample of 0.015 sec compared to the current research. Solution can be implemented in mobile device and cloud computing.

In this research is ECG is captured with the ECG device it can be connected to mobile via internet via mobile app it can send data to healthcare cloud in that clod deep recognition system is present for detection and it sends data via remote monitoring center to and from clinician to user. By this system user can send or get alerts to and from clinician**. [7]**

This research paper provides an approach to use various computer vision based deep learning techniques to automatically predict various kinds of skin diseases the system uses three publicly available image recognition architectures namely Inception V3, Inception Resnet V2,Moblienet with modifications for skin disease application and successfully predicts skin disease based on maximum voting from 3 networks. This system consists of 3 phases feature extraction, training & testing or validation phase.

The System makes use of deep learning methodology to train itself with various skin images. The main objective of this research is to achieve maximum accuracy of skin disease prediction. Mobile Net is lightweight architecture & fast model it is more preferred for mobiles & embedded appliances with small size(17 Mb), that depends on streamlined architecture that uses deep wise separate convolution. Inception V3 involves two fragments feature extraction with CNN & classification with fully connected network. Inception V3 model attains advanced accuracy in recognition with 1000 classes. **[8]**

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8. Objectives:-

The primary objective of proposed research work is to develop a low cost application which can be used to diagnose critical diseases.

The proposed development has following subsidiary objectives:-

1. Developing a module that can take symptoms as an input in the form of text that text then compared with stored database text to diagnose the critical disease with help of CNN model. This could diagnose the disease anywhere any time no need to go to hospital for detection.
2. Developing a module that can take image as an input like X-Ray,ECG etc. that can be compared with stored images to diagnose the disease with the help of CNN model.
3. Developing a module for prevention techniques for particular diseases after detection of critical disease.
4. Developing a module for medications required and what care must be taken after detection of disease.

9. Methodology:-

The methodology of implementing the proposed system is divided into following parts:-

Planning:-In planning phase collection of data, software required to do research, database etc can be collected. In this proposed research work python software, CNN model and tensor flow framework is used to diagnose the disease.

Exploring: - In this step after requirement specification, design for the proposed application is made. To understand the flow of application, data flow diagram is used.

Coding:-In this step actual programming will be done to perform some action based on events.

Testing:-After completion of coding application is tested on computer whether it is installed properly? And all modules created in it are functioning properly or not?

Installation:-The application is actually tested in health care industry or at home to diagnose the patient or in hospitals to diagnose patient.

Documentation:-During this step, the documentation will be written in the form of manual as well as thesis. The documentation will comprise of the listing of the entire code as well as other information related to software development phases.

10. Time Schedule:-

Task	Year 1				Year 2				Year 3			
	Q 1	Q 2	Q 3	Q 4	Q 5	Q 6	Q 7	Q 8	Q 9	Q 10	Q 11	Q 12
Literature Survey	↔											
Planning	↔											
Designing DFD & Flow Chart		⟷	⟷									
Analyzing the files generated by modeling software		⟷	⟷									
Finalizing the Architecture			⟷	⟷								
Procuring software tools					⟷							
Developing Module for symptoms checking						⟷	⟷					
Developing Module for images like ECG,X-Ray etc. checking							⟷	⟷				
Developing Module for prevention Techniques and Medications used for Critical Diseases.							⟷	⟷				
Testing all Application on mobile device									⟷	⟷		
Installing the application										⟷	⟷	
Documentation & Thesis Writing Etc.										⟷	⟷	⟷

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Research Student Guide